

## CLAIMS

What is claimed is:

- 1 1. A method of providing solutions to problems, the method comprising the steps of:  
2 generating problem definitions for problems;  
3 receiving environmental information required for generating solutions for  
4 the problems;  
5 generating solutions for the problems dependent upon the environmental  
6 information and the problem definitions;  
7 communicating solutions to clients before the solutions are needed.
- 1 2. The method of claim 1 wherein the problem definitions are for problems related  
2 to securities trading.
- 1 3. The method of claim 1 further comprising storing the problem definitions in  
2 problem definition records in a database.
- 1 4. The method of claim 1 further comprising storing the solutions in solutions  
2 records in the database.
- 1 5. The method of claim 4 wherein the solutions records have at least one relation to  
2 the problem definition records.
- 1 6. The method of claim 4 further comprising retrieving at least one solution from the  
2 solutions records in the database.
- 1 7. The method of claim 1 wherein at least one client is a broker-dealer computer  
2 system programmed and operated to effect securities trading.  
3

1 8. The method of claim 1 wherein received environmental information changes, the  
2 method further comprising the steps of:

3 generating additional solutions dependent upon the changed  
4 environmental information and the problem definitions; and  
5 communicating additional solutions to clients before the additional  
6 solutions are needed.

1 9. The method of claim 1 wherein problems are categorized according to type.

1 10. The method of claim 9 further comprising generating subscriptions for solutions,  
2 the subscriptions comprising relations between clients and types of problems.

1 11. The method of claim 10 further comprising submitting a request for a  
2 subscription.

1 12. The method of claim 11 further comprising creating a subscription record in  
2 response to the submission of the request for a subscription.

1 13. The method of claim 12 wherein the subscription record comprises data elements  
2 identifying a client and a problem type.

1 14. The method of claim 12 further comprising creating at least one problem  
2 definition record dependent upon problem definition rules.

1 15. The method of claim 14 wherein the problem record comprises data elements  
2 identifying problem type, side, symbol, and quantity.

1 16. The method of claim 15 wherein receiving environmental information comprises  
2 receiving market information in the form of quotes, the quotes comprising data  
3 elements further comprising side, symbol, quantity, market, and a tag.





1 33. The method of claim 31 further comprising sending to at least one market at least  
2 one solution order, the solution order comprising the side, symbol, quantity, price,  
3 and market data elements from the found solution record.

1 34. A method of providing solutions for trading securities, the method comprising the  
2 steps of:

3 receiving a level-two quote, the level-two quote comprising a symbol and  
4 at least one market participant quote, the market participant quote  
5 further comprising a quote price, a quote quantity, a quote MPID,  
6 and a quote side;

7 creating in computer memory a solution set comprising at least one  
8 solution record corresponding to each market participant quote in  
9 the level-two quote, the solution record comprising a solution  
10 symbol, a solution side, a solution MPID, a solution price, a  
11 solution quantity, and a solution latency, the solution latency  
12 comprising a latency for the market identified by the solution  
13 MPID; and

14 sending the solution set to at least one client.

1 35. The method of claim 34, wherein the client comprises an automated system for  
2 trading securities, the method further comprising the steps of:

3 storing the sent solution set in computer memory in the client system;  
4 using at least one of the sent solution records to create orders for  
5 securities; and  
6 deleting from computer memory the used solution records.

1 36. The method of claim 35 wherein the client comprises more than one automated  
2 system for trading securities and the automated systems for trading securities are  
3 scaled.



1 43. The method of claim 42 further comprising sorting the solution records according  
2 to side.

1 44. The method of claim 42 further comprising sorting the solution records according  
2 to price.

1 45. The method of claim 42 further comprising sorting the solution records according  
2 to latency.

1 46. The method of claim 42 further comprising sorting the solution records according  
2 to price and latency.

1 47. The method of claim 42 further comprising sorting the solution records according  
2 to side, price, and latency.

1 48. The method of claim 42 further comprising deleting solution latency from the  
2 sorted solution records.

1 49. The method of claim 34 further comprising creating an index for the solution set.

1 50. The method of claim 34 wherein the solution record further comprises a type  
2 code.

1 51. The method of claim 34 wherein latency comprises the difference between the  
2 time when a broker-dealer receives from a market a response to an order and the  
3 time when the order was sent to the market.

1 52. A system for providing solutions to problems, the system comprising:  
2 means for generating problem definitions for problems;  
3 means for receiving environmental information required for generating  
4 solutions for the problems;

5 means for generating solutions for the problems dependent upon the  
6 environmental information and the problem definitions;  
7 means for communicating solutions to clients before the solutions are  
8 needed.

1 53. The system of claim 52 wherein the problem definitions are for problems related  
2 to securities trading.

1 54. The system of claim 52 further comprising means for storing the problem  
2 definitions in problem definition records in a database.

1 55. The system of claim 52 further comprising means for storing the solutions in  
2 solutions records in the database.

1 56. The system of claim 55 wherein the solutions records have at least one relation to  
2 the problem records.

1 57. The system of claim 55 further comprising means for retrieving at least one  
2 solution from the solutions records in the database.

1 58. The system of claim 52 wherein at least one client is a broker-dealer computer  
2 system programmed and operated to effect securities trading.

1 59. The system of claim 52 wherein received environmental information changes, the  
2 system further comprising:

3 means for generating additional solutions dependent upon the changed  
4 environmental information and the problem definitions; and  
5 means for communicating additional solutions to clients before the  
6 additional solutions are needed.

- 1    60.    The system of claim 52 wherein problems are categorized according to type.
- 1    61.    The system of claim 60 further comprising means for generating subscriptions for  
2        solutions, the subscriptions comprising relations between clients and types of  
3        problems.
- 1    62.    The system of claim 61 further comprising means for submitting a request for a  
2        subscription.
- 1    63.    The system of claim 62 further comprising means for creating a subscription  
2        record in response to the submission of the request for a subscription.
- 1    64.    The system of claim 63 wherein the subscription record comprises data elements  
2        identifying a client and a problem type.
- 1    65.    The system of claim 63 further comprising means for creating at least one  
2        problem definition record dependent upon problem definition rules.
- 1    66.    The system of claim 65 wherein the problem record comprises data elements  
2        identifying problem type, side, symbol, and quantity.
- 1    67.    The system of claim 66 wherein means for receiving environmental information  
2        comprises means for receiving market information in the form of quotes, the  
3        quotes comprising data elements further comprising side, symbol, quantity,  
4        market, and a tag.
- 1    68.    The system of claim 67, wherein a quote is received, wherein the quote tag does  
2        not indicate that the quote is closed, the system further comprising means for  
3        finding a problem definition record having the same side and symbol as the quote.



- 1 76. The system of claim 75, wherein at least one problem definition record is found,  
2 the system further comprising means for finding, for each found problem  
3 definition record, at least one related solution record.
- 1 77. The system of claim 76 further comprising means for communicating, dependent  
2 upon data communication parameters identified in the found record of data  
3 communications parameters, to the client identified in the found subscription  
4 record at least one data element of the found solution record.
- 1 78. The system of claim 52 wherein means for communicating solutions to clients  
2 comprises means for communicating solutions to an order processing system on a  
3 broker-dealer computer.
- 1 79. The system of claim 78 further comprising means for receiving at least one  
2 customer order.
- 1 80. The system of claim 79 wherein the customer order comprises data elements  
2 identifying symbol, quantity, and optionally, price, market, and order type.
- 1 81. The system of claim 80 wherein the customer order type has a relation to the  
2 problem type.
- 1 82. The system of claim 79 further comprising means for finding at least one solution  
2 record having the same symbol as the received customer order and also having a  
3 problem type related to the customer order type in the received customer order.
- 1 83. The system of claim 82 further comprising means for sending to at least one  
2 market at least one solution order, the solution order being dependent upon the  
3 customer order and the data in the solution record.

85. A system for providing solutions for trading securities, the system comprising:  
means for receiving a level-two quote, the level-two quote comprising a  
symbol and at least one market participant quote, the market  
participant quote further comprising a quote price, a quote  
quantity, a quote MPID, and a quote side;  
means for creating in computer memory a solution set comprising at least  
one solution record corresponding to each market participant quote  
in the level-two quote, the solution record comprising a solution  
symbol, a solution side, a solution MPID, a solution price, a  
solution quantity, and a solution latency, the solution latency  
comprising a latency for a market identified by the solution MPID;  
and  
means for sending the solution set to at least one client.

1     86.     The system of claim 85, wherein the client comprises an automated system for  
2     trading securities, the system further comprising:  
3               means for storing the sent solution set in computer memory in the client;  
4               means for creating, from at least one of the sent solution records, an order  
5               for securities, wherein creating an order from the sent solution  
6               record further comprises creating a used solution record; and  
7               means for deleting from computer memory the used solution record.

1     87.     The system of claim 85 wherein the client comprises more than one automated  
2             system for trading securities and the automated systems for trading securities are  
3             scaled.

1 88. The system of claim 85 wherein means for creating a solution set further  
2 comprises means for recording in the solution record the solution side derived

3 from the quote side, the solution MPID derived from the quote MPID, the  
4 solution price derived from the quote price, and the solution symbol derived from  
5 the symbol in the level-two quote.

1 89. The system of claim 85 wherein means for creating a solution set further  
2 comprises:  
3 means for calculating the solution quantity for the solution record  
4 dependent upon the quote quantity and dependent upon a hidden  
5 quantity ratio for the market identified by the solution MPID; and  
6 means for recording the solution quantity in the solution record.

1 90. The system of claim 89 wherein the hidden quantity ratio comprises a running  
2 average of the ratios of order fill quantity to quote quantity, the order fill quantity  
3 and the quote quantity being derived from trade data comprising descriptions of  
4 executions of orders for securities.

1 91. The system of claim 89 wherein the hidden quantity ratio comprises a decaying  
2 average of the ratios of order fill quantity to quote quantity, the order fill quantity  
3 and the quote quantity being derived from trade data comprising descriptions of  
4 executions of orders for securities.

1 92. The system of claim 89 wherein the hidden quantity ratio comprises a ratio of an  
2 order fill quantity to a quote quantity, the order fill quantity and the quote quantity  
3 being derived from trade data comprising descriptions of executions of orders for  
4 securities.

1 93. The system of claim 85, wherein the solution set comprises at least two solution  
2 records, the system further comprising means for sorting the solution records to  
3 yield sorted solution records.



1 103. A solutions server comprising:  
2 a processor coupled to at least one source of environmental information  
3 and coupled to at least one client, the processor programmed to:  
4 generate problem definitions for problems;  
5 receive environmental information required for generating  
6 solutions for the problems;  
7 generate solutions for the problems dependent upon the  
8 environmental information and the problem definitions; and  
9 communicate solutions to clients before the solutions are needed;  
10 and  
11 a memory coupled to the processor, the processor programmed to store in  
12 the memory problem definitions and solutions.

1 104. The solutions server of claim 103 wherein the problem definitions are for  
2 problems related to securities trading.

1 105. The solutions server of claim 103 further comprising computer memory in which  
2 is stored the problem definitions.

1 106. The solution server of claim 105 wherein the problem definitions stored in  
2 computer memory are stored in the form of problem definitions records in a  
3 database.

1 107. The solutions server of claim 103 further comprising computer memory in which  
2 is stored the solutions.

1 108. The solutions server of claim 107 wherein the solutions stored in computer  
2 memory are stored in the form of solutions records in a database.



1 119. The solutions server of claim 117 wherein environmental information comprises  
2 market information in the form of quotes, the quotes further comprising data  
3 elements identifying side, symbol, quantity, market, and a tag.

1 120. The solutions server of claim 119, wherein a quote is received, wherein the quote  
2 tag does not indicate that the quote is closed, the processor being further  
3 programmed to find a problem definition record having the same side and symbol  
4 as the quote.

1 121. The solutions server of claim 120 wherein the processor is further programmed to  
2 search for a solution record having the same problem type, side, and symbol as  
3 the problem definition record having the same side and symbol as the quote and  
4 the same market as the quote.

1 122. The solutions server of claim 121, wherein the solution record is found, the  
2 processor being further programmed to update the solution record with the price  
3 from the quote.

1 123. The solutions server of claim 122, wherein the solution record is not found, the  
2 processor being further programmed to create a new solution record having the  
3 same problem type, side, and symbol as the problem definition record having the  
4 same side and symbol as the quote, the same market as the quote, and the same  
5 price as the quote.  
6

1 124. The solutions server of claim 123, wherein a quote is received, wherein the quote  
2 tag indicates that the quote is closed, the processor being further programmed to  
3 delete solution records having the same side, symbol, and market as the quote.

1 125. The solutions server of claim 117 wherein the processor is further programmed to  
2 repeatedly find a next subscription record so that each existing subscription record  
3 is found in turn.

1 126. The solutions server of claim 125, wherein at least one subscription record is  
2 found, the processor being further programmed to find, for each found  
3 subscription record, a related record of data communications parameters for the  
4 client identified in the found subscription record.

1 127. The solutions server of claim 126 wherein the processor is further programmed to  
2 find, for each found subscription record, at least one related problem definition  
3 record.

1 128. The solutions server of claim 127, wherein at least one problem definition record  
2 is found, the processor being further programmed to find, for each found problem  
3 definition record, at least one related solution record.

1 129. The solutions server of claim 128, wherein a data communications parameters  
2 record is found, wherein the processor is further programmed to communicate,  
3 dependent upon data communication parameters identified in the found record of  
4 data communications parameters, to the client identified in the found subscription  
5 record at least one data element of the found solution record.

1 130. The solutions server of claim 103 wherein the processor programmed to  
2 communicate solutions to clients further comprises the processor programmed to  
3 communicate solutions to at least one order processing system on a broker-dealer  
4 computer.

1 131. The solutions server of claim 130 wherein the processor is further programmed to  
2 receive at least one customer order.







1 150. The system of claim 145 wherein the processor is further programmed to sort the  
2 solution records according to side, price, and latency.

1 151. The system of claim 145 wherein the processor is further programmed to delete  
2 solution latency from the sorted solution records.

1 152. The system of claim 137 wherein the processor is further programmed to create  
2 an index for the solution set.

1 153. The system of claim 137 wherein the solution record further comprises a type  
2 code.

1 154. The system of claim 137 wherein latency comprises the difference between the  
2 time when a broker-dealer receives from a market a response to an order and the  
3 time when the order was sent to the market.

1 155. A method of providing an improved level-two quote for trading securities, the  
2 method comprising the steps of:  
3 receiving in an automated system, which system comprises at least one  
4 computer processor coupled to computer memory, a level-two  
5 quote, the level-two quote comprising a data format further  
6 comprising a symbol and at least one market participant quote, the  
7 market participant quote further comprising a data format further  
8 comprising a quote price, a quote quantity, a quote MPID, and a  
9 quote side; and  
10 creating in computer memory, dependent upon the level-two quote, an  
11 improved level-two quote comprising a symbol and at least one  
12 improved market participant quote, which improved market  
13 participant quote comprises a side, an MPID, a price, a quantity  
14 dependent upon the market participant quote quantity and also

